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Katsuya ITO, et al.

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TRANSLATOR'S DECLARATION

Honorable Commissioner for Patents

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Sir:

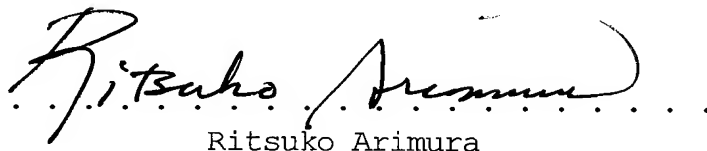
I, Ritsuko Arimura, declare:

That I am well acquainted with both the Japanese and English languages;

That the attached document represents a true English translation of Japanese Patent Application No. 2003-295634 filed on August 19, 2003; and

That I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signed this 14th day of November, 2007.


Ritsuko Arimura

(Translation)

J A P A N P A T E N T O F F I C E

This is to certify that the annexed is a true copy of the following application as filed with this Office.

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Application Number	: 295634/2003
Applicant(s)	: Toyo Boseki Kabushiki Kaisha

Commissioner, Japan Patent Office

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【To】 Yasuo Imai, Commissioner of Japan Patent Office
【International Classification】 C08J 5/18
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【List of the Annexed Documents】
 【Document】 Claims One copy
 【Document】 Specification One copy
 【Document】 Abstract One copy
 【Number of General Power of Attorney】 9709127

【Document】 Claims

【Claim 1】

A polyester film made of a polyester resin composition comprising 10 - 90 wt% of polyethylene terephthalate resin (A),
5 and 90 - 10 wt% of a polybutylene terephthalate resin and/or polytrimethylene terephthalate resin (B), which shows the number of pinholes formed by bending the film 1000 times at 23°C in a Gelbo-Flex test of not more than 5.

【Claim 2】

10 The polyester film of claim 1, having a thermal shrinkage in at least one direction of not more than 4%.

【Claim 3】

The polyester film of claim 1 or 2, wherein the polyester film has a reduced viscosity of not less than 0.75.

15 【Claim 4】

The polyester film of claim 1, 2 or 3, wherein at least one surface of the film has at least one surface treatment layer selected from an easily adhesive coating layer, a corona discharge treatment layer, a vapor-deposited metal layer, a
20 vapor-deposited inorganic oxide layer, heat-seal layer and an ink printed layer.

【Document】 Specification

【Title of the Invention】 Polyester Film

【Technical Field】

【0001】

5 The present invention relates to a polyester film superior in impact resistance and dimensional stability useful for food packages and mold processing use.

【Background Art】

【0002】

10 Films made from a polyester represented by polyethylene terephthalate resin (hereinafter the term film is used to include a sheet) are superior in mechanical strength, heat resistance, chemical resistance, insulation property, dimensional stability and the like, and utilized for various
15 applications such as packaging film, film for magnetic tape, photographic film, mold releasing film, optical film, film for electronic components and the like.

【0003】

 On the other hand, a polyamide film is used for
20 applications such as packaging bags for water-containing food, pharmaceutical products and the like, which are the fields requiring tenacity, pinhole resistance, bending resistance, bag breakage resistance on dropping, impact resistance and the like. However, polyamide film may have a degraded flatness and
25 is inferior in surface processing properties such as vapor deposition, coating and the like, has dimensional changes and is subject to problems such as curling, delamination and the like due to moisture absorption or poor dimensional stability during boiling treatment or retort treatment. Thus, there has
30 long existed an idea of expecting a polyester film having bending resistance, tenacity, pinhole resistance, bag breakage resistance on dropping and impact resistance, which shows good dimensional stability against moisture absorption.

【0004】

In these films, however, an attempt has been made to somewhat degrade the crystallinity, molecular orientation and the like of polyethylene terephthalate by mixing a polyester copolymer with polyester such as polyethylene terephthalate and the like to be the substrate (Patent Reference 1), or by using same as a part of a laminate film (Patent Reference 2), thereby to impart the films with pinhole resistance, bending resistance and impact resistance of the level corresponding to the degradation. Therefore, the problems of moisture absorption and dimensional stability during boiling treatment or retort treatment have not been resolved sufficiently. Furthermore, the film obtained may have poor transparency due to the inferior compatibility between the polyester copolymer and polyethylene terephthalate etc. to be used, and the production cost of the film becomes high because the cost of the copolymerizable components per se is high. Thus, a film satisfactory as a product comparable to a polyamide film has not been provided.

【Patent Reference 1】 JP-A-Sho52-136276

【Patent Reference 2】 JP-A-Hei06-079776

【Disclosure of the Invention】

【Problems to be Solved by the Invention】

【0005】

The present invention has been made in view of the problems of the above-mentioned conventional films, and provides a polyester film superior in mechanical strength, heat resistance, chemical resistance, insulation property and dimensional stability, and suitable for application to uses associated with boiling or retort treatment, which require bending resistance, tenacity, pinhole resistance, bag breakage resistance on dropping and the like, uses requiring thermoforming or vacuum forming, and uses such as packaging bags for water-containing food, pharmaceutical products and the like.

[Means of Solving the Problems]

[0006]

To achieve the above-mentioned object, the polyester film of the present invention is made of a polyester resin composition comprising 10 - 90 wt% of polyethylene terephthalate resin (A), and 90 - 10 wt% of a polybutylene terephthalate resin and/or polytrimethylene terephthalate resin (B), which shows the number of pinholes formed by bending the film 1000 times at 23°C in a Gelbo-Flex test is not more than 5.

[0007]

In this case, the thermal shrinkage in at least one direction may be not more than 4%.

[0008]

Here, the thermal shrinkage means a value after standing for 30 min in an atmosphere at 150°C.

[0009]

In this case, the polyester film has a reduced viscosity of not less than 0.75.

[0010]

In this case, moreover, at least one surface of the polyester film has at least one surface treatment layer selected from an easily adhesive coating layer, a corona discharge treatment layer, a vapor-deposited metal layer, a vapor-deposited inorganic oxide layer, heat-seal layer and an ink printed layer.

[0011]

The polyester film of the present invention is superior in the mechanical strength, heat resistance, chemical resistance, insulation property and dimensional stability, and can be applied to uses associated with boiling or retort treatment, which require bending resistance, tenacity, pinhole resistance, bag breakage resistance on dropping and the like, uses requiring thermoforming or vacuum forming, and uses such

as packaging for water-containing food, pharmaceutical products and the like.

【Best Mode for Embodying the Invention】

【0012】

5 The polyester film of the present invention is preferably made of a polyester resin composition containing 10 - 90 wt% of polyethylene terephthalate resin A, and 90 - 10 wt% of a polybutylene terephthalate resin and/or polytrimethylene terephthalate resin B. The polyester resin composition
10 contains polyethylene terephthalate resin A (hereinafter sometimes to be abbreviated as resin A) in a proportion of 10 - 90 wt%, preferably 15 - 70 wt%, more preferably 20 - 49 wt%, and a polybutylene terephthalate resin and/or polytrimethylene terephthalate resin B (hereinafter sometimes to be abbreviated
15 as resin B) in a proportion of 90 - 10 wt%, preferably 85 - 30 wt%, more preferably 80 - 51 wt%. When resin A is contained in a proportion of more than 90 wt%, the effect of improving pinhole resistance is small, and when resin B exceeds 90 wt%, stretchability and heat resistance of the film becomes poor due
20 to the fast crystallization rate of resin B, causing easy breakage during film forming.

【0013】

 The polyester film of the present invention shows the number of pinholes formed by bending the film 1000 times at
25 23°C in a Gelbo-Flex test of not more than 5, preferably not more than 2, more preferably 0. When the number of pinholes is not less than 6 and when the film is made into a bag filled with contents, pinholes due to bending of the bag and the like are easily developed, sometimes resulting in a failure to
30 function as a packaging material.

【0014】

 The polyester film of the present invention preferably shows a thermal shrinkage in at least one direction under an atmosphere at 150°C for 30 min of not more than 4%, more

preferably not more than 3%, further more preferably not more than 2%. More preferably, the polyester film shows a thermal shrinkage under an atmosphere at 150°C for 30 min in the longitudinal direction and the transverse direction of not more than 4% each. When the thermal shrinkage exceeds 4%, extreme size reduction, considerable deformation and the like may occur during boiling treatment or retort treatment, which unpreferably deteriorates the appearance as a product, or causes deformation of the film in the drying step after printing and the like.

【0015】

The thickness of the polyester film of the present invention is generally 5 - 1000 μm , preferably 8 - 50 μm .

【0016】

The reduced viscosity (η_{sp}/c) of the polyester film of the present invention is preferably not less than 0.75, more preferably not less than 0.80, still more preferably not less than 0.90. When it is less than 0.75, the pinhole resistance may be degraded even when the weight ratio of resin A to resin B is 90/10 - 10/90.

【0017】

In order to obtain a polyester film having a reduced viscosity (η_{sp}/c) of not less than 0.75, resin A having a reduced viscosity of not less than 0.75 and/or resin B having a reduced viscosity of not less than 0.75, which constitute the polyester resin composition, are used. It is preferable to suppress reduction of molecular weight during a film forming process, particularly a melt extrusion step. Specifically, the conditions are practically determined according to the original viscosity of the starting material by a method such as extruding at a resin temperature of not more than 280°C, shortening the residual time in the extruder, and the like.

【0018】

The polyethylene terephthalate resin A to be used in

the present invention is preferably made of a homopolymer mainly comprising terephthalic acid and ethylene glycol. As long as the heat resistance and other properties are not impaired, it may be a polyester copolymer wherein not more than 5 20 mol%, preferably 0.1 - 10 mol%, of a different acid component or a glycol component is copolymerized.

[0019]

When the polyethylene terephthalate resin to be used in the present invention is a copolymer, the following monomers 10 can be used as a copolymerizable component.

[0020]

As the dicarboxylic acid usable for copolymerization, aromatic dicarboxylic acid is exemplified by isophthalic acid, orthophthalic acid, naphthalene dicarboxylic acid, biphenyl 15 dicarboxylic acid and the like. Examples of aliphatic dicarboxylic acid include succinic acid, adipic acid, azelaic acid, sebacic acid, dodecanedioic acid, dimer acid and the like, and examples of alicyclic dicarboxylic acid include 1,4-cyclohexane dicarboxylic acid, 1,3-cyclohexane dicarboxylic 20 acid, 1,2-cyclohexane dicarboxylic acid, acid anhydride thereof and the like. Examples of dicarboxylic acid containing a polymerizable unsaturated double bond include α,β -unsaturated dicarboxylic acid (e.g., fumaric acid, maleic acid, maleic anhydride, itaconic acid, citraconic acid), alicyclic 25 dicarboxylic acid containing an unsaturated double bond (e.g., 2,5-norbornene dicarboxylic anhydride, tetrahydrophthalic anhydride) and the like.

[0021]

As the glycol usable for copolymerization, aliphatic 30 glycol having 3 to 10 carbon atoms, alicyclic glycol having 6 to 12 carbon atoms and ether bond-containing glycol and the like can be mentioned. As the aliphatic glycol having 3 to 10 carbon atoms, 1,2-propylene glycol, 1,3-propanediol, 1,4-butanediol, 1,5-pentanediol, neopentyl glycol, 1,6-hexanediol,

3-methyl-1,5-pentanediol, 1,9-nonanediol, 2-ethyl-2-butylpropanediol and the like can be mentioned. As the alicyclic glycol having 6 to 12 carbon atoms, 1,4-cyclohexanedimethanol and the like can be mentioned.

5 【0022】

Further, as the ether bond-containing glycol, polyethylene glycol, polypropylene glycol, polytetramethylene glycol, diethylene glycol, triethylene glycol, dipropylene glycol, glycols obtained by adding ethyleneoxide or
10 propyleneoxide to two phenolic hydroxyl groups of bisphenols (e.g., 2,2-bis(4-hydroxyethoxyphenyl)propane) and the like can be mentioned.

 【0023】

The polybutylene terephthalate resin to be used in the
15 present invention is preferably made of a homopolymer mainly comprising terephthalic acid and butanediol. As long as the heat resistance and other properties are not impaired, it may be a polyester copolymer wherein not more than 20 mol%, preferably not more than 10 mol%, of a different acid component
20 or a glycol component is copolymerized. In addition, the polytrimethylene terephthalate resin is preferably made of a homopolymer mainly comprising terephthalic acid and trimethylene glycol. As long as the heat resistance and other properties are not impaired, it may be a polyester copolymer
25 wherein not more than 20 mol%, preferably 0.1 - 10 mol%, of a different acid component or a glycol component is copolymerized.

 【0024】

When the polybutylene terephthalate resin or
30 polytrimethylene terephthalate resin to be used in the present invention is a copolymer, the following monomers can be used as a copolymerizable component.

 【0025】

As the dicarboxylic acid usable for copolymerization,

examples of aromatic dicarboxylic acid include isophthalic acid, orthophthalic acid, naphthalene dicarboxylic acid, biphenyl dicarboxylic acid and the like. Examples of aliphatic dicarboxylic acid include succinic acid, adipic acid, azelaic acid, sebacic acid, dodecanedioic acid, dimer acid and the like, and examples of alicyclic dicarboxylic acid include 1,4-cyclohexane dicarboxylic acid, 1,3-cyclohexane dicarboxylic acid, 1,2-cyclohexane dicarboxylic acid, acid anhydride thereof and the like. Examples of dicarboxylic acid containing a polymerizable unsaturated double bond include α,β -unsaturated dicarboxylic acid (e.g., fumaric acid, maleic acid, maleic anhydride, itaconic acid, citraconic acid), alicyclic dicarboxylic acid containing an unsaturated double bond (e.g., 2,5-norbornene dicarboxylic anhydride, tetrahydrophthalic anhydride) and the like.

【0026】

As the glycol usable for copolymerization, aliphatic glycol having 2 to 10 carbon atoms, alicyclic glycol having 6 to 12 carbon atoms, ether bond-containing glycol and the like can be mentioned. As the aliphatic glycol having 2 to 10 carbon atoms, ethylene glycol, 1,2-propylene glycol, trimethylene glycol, 1,4-butanediol, 1,5-pentanediol, neopentyl glycol, 1,6-hexanediol, 3-methyl-1,5-pentanediol, 1,9-nonanediol, 2-ethyl-2-butylpropanediol and the like can be mentioned. As the alicyclic glycol having 6 to 12 carbon atoms, 1,4-cyclohexanedimethanol and the like can be mentioned.

【0027】

Furthermore, as the ether bond-containing glycol, polyethylene glycol, polypropylene glycol, polytetramethylene glycol, diethylene glycol, triethylene glycol, dipropylene glycol, glycols obtained by adding ethylene oxide or propylene oxide to two phenolic hydroxyl groups of bisphenols (e.g., 2,2-bis(4-hydroxyethoxyphenyl)propane etc.) and the like can be mentioned.

【0028】

The polyester film of the present invention can contain any amount of fine particles in a polyester resin composition. For example, silicon dioxide, kaolin, clay, calcium carbonate, 5 calcium terephthalate, aluminum oxide, titanium oxide, calcium phosphate, silicone particles and the like can be mentioned, with preference given to inorganic lubricants. During melt mixing, additives such as stabilizer, coloring agent, antioxidant, antifoaming agent, antistatic agent and the like 10 can be added as necessary besides lubricant.

【0029】

While the method of producing the polyester film of the present invention is not particularly limited, the following method is preferable.

15 【0030】

First, in the extrusion step, resin A and resin B are mixed, cast in an extruder, melted, extruded from a T-die, adhered to a cooling roll by an electrostatic adhesion method and the like, and solidified by cooling to give a non-oriented 20 film. In this case, the temperature of an extruder is preferably set to not more than 280°C, for all of the feeding part, compression part, measuring part, filter, resin flow path and T-die of the extruder.

【0031】

25 In general, when the extrusion temperature conditions are described, the resin temperature immediately before entry of the resin into a T-die or immediately after delivery of the resin from the T-die is often taken as the temperature condition of extrusion. Therefore, even when the resin 30 temperature immediately before entry into a T-die or immediately after delivery from the T-die is controlled, it is not always the same as the resin temperature during the preceding melt extrusion step. It is a general practice to intentionally change the feeding part, compressing part,

measuring part and resin flow path such as filter of an extruder, in view of the specific condition of the machine, such as screw shape and the like, production speed and stability, and the temperature of the respective parts is in
5 fact often different from each other.

【0032】

In the present invention, it is preferable to eliminate a zone exceeding 280°C. This is because when a part exceeding 280°C exists in a resin flow path, the decomposition of resin B
10 is accelerated from around 280°C, and copolymerization due to promoted transesterification of resin A and resin B degrades heat resistance, which may decrease the stretchability during film forming or strength during heat setting, and further, the film may be whitened easily during boiling or retort treatment
15 due to the changes in the crystallization behavior.

【0033】

While the obtained non-oriented film can be used when it meets the requirements of the present invention, it is preferably obtained by orienting a non-oriented film at least
20 uniaxially, more preferably biaxially or more. The method of orientation includes tubular orientation, pantographic simultaneous biaxial orientation, linear motor simultaneous or sequential biaxial orientation, sequential biaxial orientation based on a combination of a heating roll and a tenter and the
25 like. In the case of sequential biaxial orientation, orientation methods of longitudinal-transverse, transverse-longitudinal, longitudinal-longitudinal-transverse, longitudinal-transverse-longitudinal, longitudinal-transverse-transverse, longitudinal-longitudinal-longitudinal-transverse
30 and the like can be mentioned.

【0034】

Here, the explanation is based on a sequential biaxial orientation by a general longitudinal-transverse method as an example.

5 【0035】

The obtained unoriented film is led to heated rolls having different rotation speeds and drawn 2- to 5-fold in the longitudinal direction. While the orientation temperature varies depending on the constituent resin, it is 50 - 120°C.

 【0036】

10 The longitudinally drawn film is led to a tenter and drawn 3- to 6-fold in the transverse direction. While the orientation temperature varies depending on the constituent resin, it is 70 - 150°C.

 【0037】

 In order to obtain a film of the present invention showing a thermal shrinkage in at least one direction of not more than 4%, heat setting is necessary after the orientation.
15 After completion of the transverse orientation, heat setting is successively conducted in a tenter at 200°C - 235°C, preferably 210°C - 225°C. A film having a thermal shrinkage of not more than 4% cannot be obtained when the temperature is less than 200°C. When it exceeds 235°C, the mechanical strength such as
20 breakage strength, thrust strength and the like is reduced, though the thermal shrinkage can be reduced, which then easily leads to breakage during film forming or processing, or breakage of a packaging bag and renders the film impractical. Further, the pinhole resistance is also degraded. The film
25 having a small thermal shrinkage can be easily obtained by preferably relaxing the film in the transverse direction by 2 - 7% during heat setting. It is also possible to carry out the heat setting while relaxing the film taken out from the tenter, in the longitudinal direction with a roll and the like.

30 【0038】

The polyester film of the present invention shows the number of pinholes of not more than 5, preferably not more than 2, more preferably 0, which are formed by bending 1000 times at 23°C in a Gelbo-Flex test. When the number of pinholes is not

less than 6 and when the film is made into a bag filled with contents, pinholes due to bending of the bag and the like are easily developed, sometimes resulting in a failure to function as a packaging material.

5 【0039】

In view of the running performance during film forming and processing such as printing and the like, a lubricant such as those generally added to a film can be added to the polyester film of the present invention. As lubricants,
10 silicon dioxide, kaolin, clay, calcium carbonate, calcium terephthalate, aluminum oxide, titanium oxide, calcium phosphate, silicone particles and the like can be mentioned, with preference given to inorganic lubricants. During melt mixing, additives such as stabilizer, coloring agent,
15 antioxidant, antifoaming agent, antistatic agent and the like can be added as necessary besides lubricant.

 【0040】

The polyester film of the present invention can have at least one surface treatment layer selected from an easily
20 adhesive coating layer, a corona discharge treatment layer, a vapor-deposited metal layer, a vapor-deposited inorganic oxide layer, a heat-seal layer and a printed ink layer on at least one surface thereof.

 【0041】

25 By providing an easily adhesive coating layer, the polyester film of the present invention can acquire printability, easy adhesiveness, gas barrier property, antistatic property, and the like. A coating agent to be used for the easily adhesive coating layer formed on at least one
30 surface of a polyester film is not particularly limited as long as it has adhesiveness to a polyester film. Examples thereof include coating agents made of polyester resin, polyurethane resin, polyacryl resin, polyvinyl alcohol resin and copolymers thereof, ethylene-vinyl acetate copolymer resin and the like.

To improve adhesion between a polyester film and a printed ink layer, a vapor-deposited layer and the like, a polyester resin coating agent is preferably used. One-component or two-component polyurethane resin coating agents are also
5 preferable. Specific examples of the two-component polyurethane coating agent include product name Takerak A2027 and Takenate A3 (both manufactured by Takeda Pharmaceutical Company Ltd.). As the polyester resin coating agent, product name VYLON (manufactured by Toyo Boseki Kabushiki Kaisha) can
10 be mentioned.

【0042】

In the present invention, an easily adhesive coating layer can contain fine particles, antistatic agent, surfactant, antioxidant, light shielding agent, antigelling agent and the
15 like. As the fine particles, for example, inorganic particles having a particle size of about 0.01 - 10 μm , such as calcium carbonate, sedimentary barium carbonate, silica, talc and the like, and organic particles such as polystyrene, polyester, melamine, benzoguanamine, acrylic particles and the like can be
20 mentioned.

【0043】

In the present invention, when an easily adhesive coating layer is to be formed, a preferable method preferably comprises applying a coating solution to a uniaxially oriented
25 film, and feeding the sheet to a tenter and drawing the sheet in the perpendicular direction, thereby simultaneously preventing degradation of film forming stability and transparency, maintaining water resistance of the easily adhesive coating layer, preventing delamination and breakage of
30 vapor-deposited layer during boiling treatment, and preventing degradation of gas barrier property after boiling treatment. In this case, it is also preferable to apply a coating solution to a uniaxially oriented film, dry the film and then lead the film to a tenter. Since the polybutylene terephthalate resin

and the polytrimethylene terephthalate resin show a faster crystallization rate as compared to a polyethylene terephthalate resin, the transverse orientation temperature and the preheating temperature before that need to be set higher, 5 when the coating solution is led to a tenter without drying, which causes easy occurrence of whitening due to crystallization (high haze) and breakage of the film. Therefore, an easily adhesive coating layer is preferably dried at 40°C - 70°C after coating. When the drying temperature 10 exceeds 70°C, crystallization of uniaxially oriented film begins, which easily cause whitening and breakage. When the drying temperature is less than 40°C, drying tends to become insufficient.

【0044】

15 As a method for forming an easily adhesive coating layer in the present invention, conventional coating methods can be used. For example, gravure coating, micro gravure coating, bar coating, reverse roll coating, reverse kissroll coating, comma coating, dam coating, curtain coating, dip 20 coating, blade coating and the like can be employed.

【0045】

In addition, a surface activation treated (e.g., corona discharge treatment) layer can be formed on at least one surface of the polyester film of the present invention. Since 25 such surface modification means modification of the polar group on the film surface, the wetting property of the film surface can be improved, and when the wetting tension of the surface of the surface activation treated layer is set to not less than 35 dyne/cm, ink absence during printing can be reduced.

30 【0046】

It is also possible to afford gas barrier property by forming a vapor-deposited metal layer or a vapor-deposited inorganic oxide layer on at least one surface of the polyester film of the present invention. As a metal preferable for

forming a vapor-deposited metal layer, aluminum, palladium, zinc, nickel, gold, silver, copper, indium, tin, chrome, titanium and the like can be mentioned. Representatively, aluminum is used. As an inorganic oxide preferable for forming
5 a vapor-deposited inorganic oxide layer, any can be used as long as a vapor-deposited layer of an inorganic oxide, which shows transparency and gas barrier property, can be formed. Metal oxides and nonmetal oxides are widely used, and particularly, a vapor-deposited layer comprising silicon oxide
10 and/or aluminum oxide as main components is preferable. While the film thickness of the vapor-deposited layer of a metal or inorganic oxide is not limited and may be any, it is within the range of generally 10 - 5000 Å, more preferably 50 - 2000 Å.

【0047】

15 A vapor-deposited layer of a metal or inorganic oxide can be formed by physical vapor deposition methods such as vacuum vapor deposition, sputtering, ion plating and the like, chemical vapor deposition methods such as CVD and the like, and the like as appropriate. As a heating method employed here,
20 resistance heating, induction heating, electron beam heating and the like can be employed as appropriate. As a reaction gas, oxygen, nitrogen, hydrogen, argon, carbon gas, water vapor and the like can be introduced, or reactive vapor deposition using ozone addition, ion assist etc. may be employed. In
25 addition, bias may be applied to a substrate, and film forming conditions such as heating and cooling of a substrate, may be changed. Such vapor deposition material, reaction gas, substrate bias, and heating and cooling conditions can be changed in the same manner when performing sputtering or CVD.
30 The surface of a vapor deposited substrate may be subjected to a corona discharge treatment, a flame treatment, a low temperature plasma treatment, a glow discharge treatment, a reverse sputtering treatment, a surface roughening treatment and the like, before or during vapor deposition with a metal or

inorganic oxide, thereby still more increasing the adhesion strength of a metal or inorganic oxide effectively.

【0048】

Moreover, the polyester film of the present invention
5 can acquire thermal adhesiveness by having a heat-seal layer comprising polyolefin such as homopolymer (e.g., polyethylene, polypropylene, polybuten and the like), copolymer having the monomer components thereof, and the like. As a method for providing a heat-seal layer, a method of providing the layer
10 during film forming by extrusion lamination, film lamination or coextrusion method, and the like can be mentioned.

【0049】

In addition, the polyester film of the present invention can have a printed ink layer formed on at least one
15 surface thereof. A printed ink layer can be formed by any method from gravure printing, offset printing, screen printing or other printing method, which is determined according to the film thickness, size, continuous or sheet feeding, and the like. Most generally, a printed ink layer is formed on a
20 continuous film by gravure printing or offset printing.

【0050】

As the printing ink used for forming a printed ink layer is one generally used, such as an ink comprising a coloring material comprising a pigment or dye, a binder and a
25 volatile organic solvent as constituent components. When light, particularly UV, is to be blocked with the printed ink layer, an ink layer having UV blocking property is formed.

【0051】

In general, after forming a printed ink layer on a
30 polyester film, a heat-seal layer is laminated or applied on a surface opposite to the surface in contact with the polyester film of the printed ink layer. After printing, therefore, a method comprising continuously laminating a heat-seal layer is most efficient and advantageous in terms of cost.

【0052】

The polyester film of the present invention can be effectively utilized for use for which a nylon film is conventionally employed, which is specifically a packaging
5 material requiring pinhole resistance and bag breakage resistance, particularly, a food packaging material for fish processed products involving a boiling treatment or a retort treatment, pickles, daily dishes, livestock meat processed products and the like, based on the superiority of polyester in
10 the heat resistance and moisture absorption dimensional stability. Moreover, it can be effectively utilized as packaging for industrial materials such as pet food, agricultural chemicals, fertilizers, infusion pack, or semiconductor, precision material and the like, as well as
15 medical, electronic, chemical, mechanical products and the like. In addition, it can be utilized as a material of packaging involving vacuum forming and air pressure forming, such as molded containers and the like, and a material of prepaid cards and electronic equipment cases, taking advantage
20 of heat resistance, impact resistance and crystallization properties of the polyester film.

【Examples】

【0053】

The present invention is explained in detail in the
25 following by referring to Examples. Each property value was measured as shown below.

【0054】

1. Gelbo test evaluation

In a Gelbo-Flex tester (manufactured by TESTER SANGYO
30 CO., LTD., serial number 27793), the ambient temperature was set to 23°C, a sample film (distance between chucks 178 mm, diameter 89 mmφ) was subjected to repetitive (1000 cycles) strain under the conditions of twisting angle 440°, stroke length 155 mm, and the number of pinholes after the twisting

treatment was counted (the number of ink penetration on the filter paper was counted). Five sample pieces were subjected to the measurement, and the numbers of the obtained pinholes were averaged and the average pinhole number was taken as the number of pinholes, based on which the pinhole resistance was compared.

【0055】

2. Thermal shrinkage

A sample was cut into 10 mm X 150 mm, and gauge lines were marked at 100 mm intervals on 10 sample pieces. They were left standing in a gear oven at 150°C for 30 min. without a load, after which they were taken out and the distance between gauge lines was measured at room temperature. The values were determined according to the following formula and an average value of 10 sample pieces was taken as the thermal shrinkage (%) of each sample.

【0056】

$$\text{thermal shrinkage} = ((A-B)/A) \times 100$$

A: distance between gauge lines before heating

B: distance between gauge lines after heating

【0057】

3. Reduced viscosity

Reduced viscosity (η_{sp}/c)

A polymer (0.125 g) was dissolved in phenol/tetrachloroethane = 6/4 (weight ratio) (25 mL) and measurement was performed at 25°C with a Ubbelohde viscometer. The unit was dL/g. The resin was in the form of chips, and the film was cut finely and used for the measurement.

【0058】

4. Boiling test

As a sealant film, a nonoriented polypropylene film (manufactured by Toyo Boseki Kabushiki Kaisha: P1153: 50 μm) was dry laminated on the obtained polyester film, and four sides were sealed with an impulse sealer. Bags (150 mm X 150

mm) containing water were produced, immersed in hot water at 95°C for 30 min. The presence or absence of bag breakage and defective appearance of the bag surface (wrinkle, whitening) was evaluated.

5 **【0059】**

5. Retort test

As a sealant film, a nonoriented polypropylene film (manufactured by Toyo Boseki Kabushiki Kaisha: P1153: 50 μ m) was dry laminated on the obtained polyester film, and four
10 sides were sealed with an impulse sealer. Bags (150 mm X 150 mm) filled with water were produced, subjected to a retort treatment at 120°C for 30 min. The presence or absence of bag breakage and defective appearance of the bag surface (wrinkle, whitening) was evaluated.

15 **【0060】**

6. Printing test

Using a three-color gravure printer (manufactured by Modern Machinery, Ltd.), blue, red and white of gravure ink "UNIVURE A" manufactured by Dainippon Ink and Chemicals
20 Incorporated were sequentially printed on one surface of the obtained polyester film by gravure printing, and defective appearance and printing displacement were visually evaluated. The printing was performed at a rate of 50 m/min, drying temperature 90°C.

25 **【0061】**

7. Vibration test

As a sealant film, a nonoriented polypropylene film (manufactured by Toyo Boseki Kabushiki Kaisha: P1153: 50 μ m) was dry laminated on the obtained polyester film, and four
30 sides were sealed with an impulse sealer. Ten bags (100 mm X 100 mm) containing water were produced, and each bag was put in 10 cardboard boxes (width 200 mm X depth 200 mm X height 40 mm). The boxes were set in 2 lines each having 5 piled boxes and vibrated under an atmosphere of 10°C at vibration amplitude

50 mm and vibration velocity of 180 reciprocations/min for 10 hours as a model of actual product transportation. The average number of pinholes developed was taken.

【0062】

5 (Example 1)

Polyethylene terephthalate resin A1 (reduced viscosity 0.75) comprising 2000 ppm of silicon dioxide (F) (manufactured by FUJI SILYSIA CHEMICAL LTD.: Silysia 310) previously added during polymerization as resin A and polybutylene terephthalate
10 resin B1 (reduced viscosity 1.20) as resin B were cast into a single screw extruder (65φ) at resin A1/resin B1 = 40/60 (parts by weight). For temperature setting of the extruder, temperatures of a feeding part (Ex1), a compressing part (Ex2), a measuring part (Ex3), the flow path up to a filter, the
15 filter part, the flow path up to a die, and the die of the extruder were set, where Ex1 was 240°C, from Ex2 to the filter part was 260°C, and thereafter was 255°C, and resins were supplied. The temperature of the resins measured immediately after extrusion from the T-die was 258°C. A 200 mesh filter
20 was used. The resins extruded from the T-die was rapidly cooled on a roll cooled to 20°C according to an electrostatic adhesion to give a non-oriented film having a thickness of about 200 μm. The film was supplied to a roll drawing machine, and drawn 3.4-fold in the longitudinal direction at 80°C.
25 Subsequently, the sheet was transversely drawn 3.8-fold at 95°C in a tenter, and heat set *in situ* at 200°C for about 10 seconds and at 210°C for about 10 seconds in the tenter while relaxing by 7% in the transverse direction to give a polyester film having a thickness of about 15 μm. The properties of the
30 obtained film were evaluated. The results thereof are shown in Table 1.

【0063】

(Example 2)

In the same manner as in Example 1 except that the

starting material was resin A1/resin B1 = 85/15 (parts by weight), the temperature conditions of extrusion step were set to 250°C for Ex1, 270°C from Ex2 to the filter part, and 255°C thereafter, the orientation temperature in the longitudinal
5 direction was set to 105°C, and the orientation temperature in the transverse direction was set to 115°C, a polyester film was obtained. The properties of the obtained film were evaluated. The results thereof are shown in Table 1.

【0064】

10 (Example 3)

In the same manner as in Example 1 except that the starting material was resin A1/resin B1 = 15/85 (parts by weight), the orientation temperature in the longitudinal direction was set to 52°C, and the orientation temperature in
15 the transverse direction was set to 72°C, a polyester film was obtained. The properties of the obtained film were evaluated. The results thereof are shown in Table 1.

【0065】

(Comparative Example 1)

20 In the same manner as in Example 1 except that polyethylene terephthalate resin A2 (reduced viscosity 0.65) comprising 2000 ppm of silicon dioxide (F) (manufactured by FUJI SILYSIA CHEMICAL LTD.: Silysia 310) previously added during polymerization was used as resin A and polybutylene
25 terephthalate resin B2 (reduced viscosity 0.75) was used as resin B and they were used at resin A2/resin B2 = 50/50 (parts by weight), a polyester film was obtained. The properties of the obtained film were evaluated. The results thereof are shown in Table 1.

30 **【0066】**

(Comparative Example 2)

In the same manner as in Example 2 except that the starting material was resin A1/resin B1 = 95/5 (parts by weight), a polyester film was obtained. The properties of the

obtained film were evaluated. The results thereof are shown in Table 1.

【0067】

(Comparative Example 3)

5 In the same manner as in Example 2 except that the heat setting treatment after transverse orientation was applied at 225°C for about 10 seconds and at 235°C for about 10 seconds, a polyester film was obtained. The properties of the obtained film were evaluated. The results thereof are shown in Table 1.

10 **【0068】**

(Comparative Example 4)

 In the same manner as in Example 1 except that, as the conditions of the extruder, the temperature was set to 285°C from Ex2 to the filter part and 275°C thereafter, a polyester
15 film was prepared. The temperature of the resin immediately after T-die was 278°C. The properties of the obtained film were evaluated. The results thereof are shown in Table 1.

【0069】

The above-mentioned results are shown in Table 1.

20 **【0070】**

[Table 1]

		Ex. 1	Ex. 2	Ex. 3	Comp. Ex. 1	Comp. Ex. 2	Comp. Ex. 3	Comp. Ex. 4
starting material polyester resin	A1	50	85	15	-	95	50	50
	A2	-	-	-	50	-	-	-
	B1	50	15	85	-	5	50	50
	B2	-	-	-	50	-	-	-
extruder compressing part temperature (°C)		260	270	260	260	260	260	285
die outlet resin temperature (°C)		258	260	258	258	258	258	278
heat setting treatment temperature (°C)		200 210	200 210	200 210	200 210	200 210	225 235	200 210
reduced viscosity (dL/g)		0.88	0.77	1.04	0.72	0.73	0.88	0.74
thermal shrinkage (150°C, 30 min) (%)	longitudinal	3.0	3.1	3.0	3.0	3.3	1.1	3.1
	transverse	2.8	2.8	3.0	2.9	3.0	1.2	2.8
Gelbo test evaluation (pinholes)		2	5	2	24	35	12	14
boil evaluation (appearance)		fine	fine	fine	fine	fine	fine	fine
retort evaluation (appearance)		fine	fine	fine	whit- ened	fine	fine	whit- ened
gravure printing evaluation (appearance)		fine	fine	fine	fine	fine	fine	fine
vibration test evaluation (pinholes)		1	2	0	5	7	4	3

【0071】

While the polyester film of the present invention has been described based on plural Examples in the above, the present invention is not limited to the constitutions described
5 in the Examples above, but rather, various changes may be made to the constitution as appropriate without departing from the gist of the present invention, such as appropriate combination of the constitutions described in respective Examples and the like.

10 【Industrial Applicability】

【0072】

As mentioned above, since the polyester film of the present invention is characteristically superior in mechanical strength, heat resistance, chemical resistance, insulation
15 property and dimensional stability, it can be preferably applied for the uses associated with boiling or retort treatment, which require bending resistance, tenacity, pinhole resistance, bag breakage resistance on dropping and the like, uses requiring thermoforming or vacuum forming, and uses such
20 as packaging for water-containing food, pharmaceutical products and the like.

【Document】 Abstract

【Summary】

【Problem】 Provision of a polyester film superior in mechanical strength, heat resistance, chemical resistance, insulation property and dimensional stability, and suitable for application to uses associated with boiling or retort treatment, which require bending resistance, tenacity, pinhole resistance, bag breakage resistance on dropping and the like, uses requiring thermoforming or vacuum forming, and uses such as packaging for water-containing food, pharmaceutical products and the like.

【Solving Means】 A polyester film made of a polyester resin composition comprising 10 - 90 wt% of polyethylene terephthalate resin (A), and 90 - 10 wt% of a polybutylene terephthalate resin and/or polytrimethylene terephthalate resin (B), which shows the number of pinholes formed by bending the film 1000 times at 23°C in a Gelbo-Flex test of not more than 5.

【Main Drawing】 none

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